

Condensed Title:

A Resolution Of Approving The Agreement With IBM For The Design, Deployment, And Management Of A Citywide Wireless Network (Wi-Fi); Acceptance Of Public Benefits Offered By IBM; Authorizing The Mayor And City Clerk To Execute An Agreement With IBM; And Further Appropriating Funds In The Amount Of \$1,886,652 From The Information And Communication Technology Fund.

Key Intended Outcome Supported:

Improve process through Information Technology; and Increase community satisfaction with City services.

Issue:

Shall the City Commission Approve the Resolution?

Item Summary/Recommendation:

The Mayor and Members of the City Commission (the "City Commission") at its December 7, 2005 meeting adopted Resolution No. 2005-26084, which directed the Administration to negotiate simultaneously, with both International Business Machines (IBM) and Wireless Facilities, Inc. (WFI). Additionally, the City Commission directed the Administration to perform a pilot test of both IBM's and WFI's networks.

The City's WiFi Consultant, Civitium's bottom line regarding the pilot testing is that both networks performed well with no significant differences given the variations in Radio Frequency (RF) environment and land use. **The IBM proposed 2.4 GHz Tropos solution for meshing and access layer offers the advantage of built-in 8-10 hour back-up battery that can accommodate 480 volts of power on the streetlight poles in the South Beach area.**

It is important to note that IBM demonstrated a great understanding of the City's needs and clearly desires to establish a long term win-win relationship with the City. During the negotiations' process, the City was successful in lowering the proposed cost as presented to the City Commission on December 7, 2005, from \$5,690,154 to \$5,167,800, a savings to the City of \$526,372.

IBM's best and final price is \$125,389 lower than WFI's best and final price, and includes significant difference in added value in public benefits; IBM -- \$5,167,800; and WFI -- \$5,293,189

Advisory Board Recommendation:**Financial Information:**

Source of Funds:	Amount	Account	Approved
1	\$1,886,652	Information and Communication Technology Fund.	
2			
3			
4			
Total			

Financial Impact Summary:**City Clerk's Office Legislative Tracking:**

Gus Lopez, ext. 6641

Sign-Offs:

Department Director	Assistant City Manager	City Manager
GL GA	PDW <i>[Signature]</i>	JMG <i>[Signature]</i>



MIAMIBEACH

AGENDA ITEM R7D
DATE 3-8-06



MIAMIBEACH

City of Miami Beach, 1700 Convention Center Drive, Miami Beach, Florida 33139, www.miamibeachfl.gov

COMMISSION MEMORANDUM

TO: Mayor David Dermer and Members of the City Commission

FROM: Jorge M. Gonzalez, City Manager

DATE: March 8, 2006

SUBJECT: **RESOLUTION OF THE MAYOR AND CITY COMMISSION OF THE CITY OF MIAMI BEACH, FLORIDA, APPROVING THE AGREEMENT BETWEEN INTERNATIONAL BUSINESS MACHINES (IBM) CORPORATION AND THE CITY OF MIAMI BEACH, FOR THE DESIGN, DEPLOYMENT, AND MANAGEMENT OF A CITYWIDE WIRELESS NETWORK (Wi-Fi); IN THE BASE ESTIMATED AMOUNT OF \$4,498,800, WHICH INCLUDES THE COST FOR THE NETWORK INFRASTRUCTURE, ARCHITECTURE AND DESIGN SERVICES, INSTALLATION, AND SIX (6) YEARS OF OPERATION, MAINTENANCE, PROJECT MANAGEMENT, SUPPORT AND WARRANTY SERVICES; OPTION NO. 2 FOR A 100% CITYWIDE ACCESS IN THE ESTIMATED AMOUNT OF \$669,000; PROJECT CONTINGENCY IN THE AMOUNT OF \$248,771; ACCEPTANCE OF PUBLIC BENEFITS OFFERED BY IBM; AUTHORIZING THE MAYOR AND CITY CLERK TO EXECUTE AN AGREEMENT WITH IBM; AND FURTHER APPROPRIATING FUNDS IN THE AMOUNT OF \$1,886,652 FROM THE INFORMATION AND COMMUNICATION TECHNOLOGY FUND.**

ADMINISTRATION RECOMMENDATION

Adopt the Resolution.

FUNDING

The Information and Communication Technology Fund appropriation for Fiscal Year (FY) 05/06 cost consists of the following: 1) \$1,449,509 for capital equipment plus a 20% contingency of \$248,771 for a total capital cost of \$1,698,290; 2) Option 2 (100% Citywide access capital cost of \$56,160; and 3) operating costs of \$132,212 for FY 05/06. The FY 06/07 through FY 11/12 operating costs of \$3,529,919, will be funded from Information and Communication Technology Fund future budgets.

ANALYSIS

The Mayor and Members of the City Commission (the "City Commission") at its December 7, 2005 meeting adopted Resolution No. 2005-26084, which directed the Administration to negotiate simultaneously, with both International Business Machines (IBM) and Wireless Facilities, Inc. (WFI). Additionally, the City Commission directed the Administration to perform a pilot test of both IBM's and WFI's networks.

PILOT TEST

The Administration provided both IBM and WFI with four (4) proposed sites for their selection and ranking in order of preference – one being the most preferable and number four being the least preferable.

IBM selected Location A, South Beach, and WFI selected Location C, Middle Beach. It was subsequently discovered that there did not exist a sufficient number of City-owned street poles for WFI to deploy their network in Middle Beach. Therefore, both IBM and WFI were informed and afforded an opportunity to select another location. IBM elected to pilot their network in South Beach, and WFI elected to pilot their network in North Beach.

Both IBM and WFI were provided with the performance criteria for the pilot testing. See attachment labeled "Performance Criteria for City of Miami Beach Pilot Testing".

Both IBM and WFI were provided with the same timeline for pilot network implementation timetable which was considered and agreed to by both IBM and WFI. Additionally, both IBM and WFI were afforded an opportunity to participate in several conference calls between the Administration and our WiFi Consultant, Civitium, to ensure an understanding of the pilot testing criteria and process.

The City's WiFi Consultant, Civitium, and their test team partner, Wireless-nets, Ltd. (the "Test Team"), developed the test plan and led the testing efforts for the IBM and WFI pilot systems. The testing was conducted to assess IBM and WFI system's ability to support the technical requirements defined in RFP No. 36-04/05 for the Design, Deployment and Management of a Citywide Wireless Network.

The Test Team performed testing on the following dates: 1) IBM – January 30-31, 2006; and 2) WFI – February 1-2, 2006. The testing was accomplished during the hours of 9:00 a.m. and 8:00 p.m. each day.

On February 21, 2006, the Test Team submitted its procedures and findings in the attached report entitled "Municipal Wi-Fi Pilot Test Report". Both networks performed well with no significant differences given the variations in Radio Frequency (RF) environment and land use. The Test Team's Report is summarized as follows:

1. Connection Testing. The Test Team observed a packet trace of the communications taking place during the association process between the laptop and the mesh node for each configuration. There was no abnormal protocol behavior during the association processes.
2. Signal Coverage Testing. The IBM and WFI pilot systems both met signal coverage requirements as stated in the RFP. **It is important to note that the WFI system had the advantage of a much higher vantage point (rooftop**

approximately 15 stories high) for mounting the antennas at the headend. This allowed most if not all mesh nodes of the WFI system to be within line of sight of the headend antennas. The IBM system made use of a much lower rooftop (approximately 8 stories high) for mounting the headend antennas. Many of the mesh nodes within the IBM system were not within line of sight of the headend antennas. Obstructions such as trees and buildings were between mesh nodes, gateways, and the headend. Despite these issues, the signal coverage of the IBM pilot system met requirements and was just as good if not better than the WFI system.

3. **Performance Testing.** The IBM and WFI pilot systems exceeded the minimum 1 Mbps upstream and downstream throughput requirements stated in the RFP. The IBM and WFI pilot systems both have sufficient capacity to support 676 subscribers per square mile. This equates to approximately 20 subscribers per mesh node. The systems can both support this number of subscribers actively checking email and browsing the Internet simultaneously.
4. **Roaming Testing.** Due to traffic and speed limits, the maximum speed attained was 35 miles per hour when testing both pilot systems. Roaming was not seamless for both the IBM and the WFI systems. Both systems exhibited periodic disconnections from the network and average re-association times of up to a minute. Because the testing was done with a laptop and common radio card, these results are characteristic of typical user devices. This will mostly impact the downloading of larger files and the ability to support real-time voice applications while moving at vehicular speeds. Roaming would likely be better, however, if using a client device having a radio specially designed for roaming. There were no issues with seamless roaming on either system when traveling at pedestrian speeds through the pilot test areas. **However, IBM's proposal includes a NetMotion solution for session persistence for 600 licenses for usage by City employees.**
5. **Battery Backup Testing.** The IBM and WFI pilot systems demonstrated the ability to remain in operation for at least 1 hour after the electrical power was removed.

The Testing Team's bottom line regarding the pilot testing is that both networks performed well with no significant differences given the variations in Radio Frequency (RF) environment and land use.

CONTRACT DISCUSSIONS

The contract discussions with both IBM and WFI were conducted in an open, fair and competitive process, with focus on achieving the City's goals and objectives of providing:

- 1) A universal, robust, and secure wireless broadband throughout the City at a level sufficient to support public safety and other government use; and 2) provide free hot zones at the specified locations for public access.

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The City's Chief Financial Officer (CFO) led the contract discussions with both IBM and WFI, and was assisted by Civitium, the Law Firm of Leibowitz and Associates, and members of the Information Technology Department and the City's Procurement Director.

After numerous contract discussions over the past several months with IBM and WFI, on February 21, 2006, both IBM and WFI submitted their best and final offers. Based on an analysis of IBM's and WFI's best and final offers, the Administration and our WiFi Consultant, Civitium, determined that IBM's offer is the best value solution for the City's WiFi initiative.

It is important to note that IBM demonstrated a great understanding of the City's needs and clearly desires to establish a long term win-win relationship with the City. **During the negotiations' process, the City was successful in lowering the proposed cost as presented to the City Commission on December 7, 2005, from \$5,690,154 to \$5,167,800, a savings to the City of \$526,372.**

IBM's best and final price is \$125,389 lower than WFI's best and final price, and includes significant difference in added value in public benefits.

IBM -- \$5,167,800

WFI -- \$5,293,189

The IBM proposed 2.4 GHz Tropos solution for meshing and access layer offers the advantage of built-in 8-10 hour back-up battery that can accommodate 480 volts of power. As a result, the City does not have to exercise option three (3) for battery back-up, or provide step-down power transformers to accommodate these devices on the streetlights in the South Beach area.

ADDED VALUE – PUBLIC BENEFITS

The City was very successful in obtaining from IBM "added value" by way of public benefits that provide significant value to the City's community. The "added value" public benefits include but are not limited to:

1. High Rise, Condominium and Hotel Installation Discount Program

- a. IBM will provide packaged pricing to Condominiums, Multiple Dwelling Units and Hotels referred by the City of Miami Beach for wireless access.
- b. Each multiple unit dwelling requires an inspection and determination of the most appropriate solution(s).
- c. Options for deployment:
 - i. Distributed Antenna Systems
 - ii. Wireless bridge from the City Wide wireless network
 - iii. Fiber, if available

- iv. Internal access points
- v. External wireless base station
- d. Packaged pricing
 - i. These prices are offered on a multiple unit basis.
 - ii. Pricing will be extended to the City of Miami Beach referrals at State of Florida Contract terms and pricing generally reserved for State and Local entities only.
 - iii. Current hardware discount rate associated with this solution is 25% off list price for the Alvarion equipment.
 - iv. Services will be offered at approximately 25% discount off list price with terms consistent with the State of Florida Services Contract on a fixed price basis.

2. Miami Beach Schools and Citywide Content Filtering Solution

The City of Miami Beach has requested a Content Filtering solution as an addition to the Citywide Wireless Network to enforce usage policies the City may wish to establish.

- a. IBM can provide the Websense Enterprise Suite as an enhancement to the WiFi Solution for filtering and reporting.
- b. IBM is proposing a filtering software and services bundle to include:
 - i. Websense Enterprise Suite
 - ii. Unlimited database downloads
 - iii. Software maintenance for filtering
 - iv. Monitoring and Reporting
 - v. Configuration and Integration Services into WiFi Network
 - vi. Standard Technical Support
- c. Special bundled pricing is offered for blocks of 2000 licenses and subscription term of 34 months.

Description	QTY	Per Seat List Price	Ext List Price	Discount	Extended Discounted Price
Websense Enterprise for 2,000 Internet Access Devices for 34 month subscription	2000	\$42.00	\$84,000.00	35%	\$54,600.00

3. IBM Community Outreach Commitment

IBM will work with the City of Miami Beach, Miami-Dade Schools, and other not for profits including organizations that provide services to the elderly at the City to

explore similar opportunities for community outreach as a commitment to our partnership. IBM will provide the following:

- a. Promote Technology Careers in the Classroom Program
 - i. IBM will provide three one to two hour labs per year to introduce the children of the City of Miami Beach to the range of exciting, profitable careers in engineering and IT.
 - ii. These labs are available to any of the City's Schools or Community Centers.
 - iii. The presentations and labs can be offered to the City's children from ages 11 to 17. The content, presentation, and activities will be tailored to the target age group.
 - iv. There are four engaging presentations to choose from and each includes hands-on activities and will make the school or community center visit fun, easy and successful. Presentations and activities include:
 - Encourage math & science – children 11-14
 - Encourage math & science – children 14-17
 - Preparing for an IT career
 - Preparing students presentation
 - Preparing students presentation (with animation)
 - IT Careers: Getting started and activities guide
 - IT Careers: Workplace simulation
 - IT Careers: Jobs overview
 - IT Careers: Discussion starters
 - v. These sessions will be conducted by qualified IBM employees who are engineers or IT Professionals that have completed the 2 hour training requirement to lead these workshops.
- b. Technology Workshops and Training for Teacher, Community Center Personnel, Adults and Seniors
 - i. IBM will provide 3 technology training workshops per year
 - ii. These workshops are available to any of the City's Schools, Community Centers, or senior homes.
 - iii. The workshops will be targeted and customized as applicable for teachers, education staff, parents or seniors.
 - iv. The purpose of these workshops is to help participants learn about acceptable Internet use and challenges/concerns about integrating technology into education or community programs
 - v. Each workshop can consist of any two of the following sessions plus Module 8 – City of Miami Beach WiFi Network Overview:
 - MODULE 1: Getting Connected
 - MODULE 2: Tips for Searching the Internet
 - MODULE 3: Downloading from the Internet
 - MODULE 4: Netiquette
 - MODULE 5: Internet Troubleshooting
 - MODULE 6: Fun things to do on the Internet
 - MODULE 7: Safety on the Net
 - MODULE 8: City of Miami Beach WiFi Network Overview

- vi. IBM will provide all the materials for each session including the presentation materials, participant handouts and activity worksheets.
- vii. IBM will coordinate the use of each facility's computer resources if required for a particular session.

4. Miami Beach Schools Technology Program

- a. IBM will provide thirty (30) PCs to the City of Miami Beach Commission to distribute specifically for the use of the underprivileged.
- b. IBM will donate these PCs to an existing 501.3c organization.

5. IBM Equipment Purchase Program at IBM Employee Pricing

- a. IBM will create and manage a customized Purchase Program portal site specifically for the City of Miami Beach and its residents to provide the same level of discount for IBM and Lenovo products available to IBM employees.
- b. Program is available to Miami Beach residents for personal use
- c. Program is available to Miami Beach City employees for personal use
- d. Discounts are in addition to special promotions.
- e. Purchasable items include notebooks, desktop PCs, monitors, keyboards and other accessories.

6. Capacity Injection for Events

Though the proposed network is designed to handle a higher user load than Miami Beach initially requested, there may be a need to augment capacity in areas where an event is concentrated.

The method IBM will use to deliver consistent service to the guests and residents of Miami Beach will be through the network operations center. IBM will baseline the network activity at all points of the network on a regular basis so that existing capacity can be gauged. As events are expected, IBM will be able to determine if excess capacity might be needed.

- 1. IBM will provide a capacity injection kit and will deploy it to a specific area where an event might warrant additional capacity.
 - a. The Capacity Injection Kit will consists of:
 - i. Quantity of 5 Tropos 5210 Metro Mesh Routers
 - ii. Quantity of 1 Alvarion 5.8GHz CPE (SU-A)Subscriber Unit
 - iii. Site survey
 - iv. Configuration and Implementation Services

2. Each capacity injection kit will provide up to 270mbps of additional capacity at the access layer and 45mbps at the backhaul layer.
3. The cost of the deployment and equipment for the capacity injection kit will be \$24,200 to \$30,000.
4. The price range and capacity estimates are contingent on:
 - a. The proximity to an existing backhaul aggregation point
 - b. Line of sight conditions to an existing backhaul aggregation point
 - c. Having sufficient capacity at the target backhaul aggregation point to handle the increase in capacity
 - d. Having adequate city supplied mounting infrastructure and power on which to deploy the injection capacity kit.
5. IBM will determine the best solution to provide the required capacity as the requirements for a specific event become available and the site survey is conducted.

7. Location Awareness Capability

IBM will explore the applicability of location tracking with the City of Miami Beach by evaluating various hardware and software solutions that run on the WiFi network at no charge to the City.

8. Wireless Connectivity for Causeway and Jail Routes

IBM will explore with the City various methods to establish "out of city" network connectivity for public safety officials who need to travel outside of the boundaries of the Miami Beach WiFi network.

- a. IBM will provide exploratory services in the amount of 100 hours to establish a desired solution.
- b. IBM will extend the State of Florida hardware contract pricing for the elements of the network being deployed in Miami Beach. This pricing is currently between 20% and 35% off of list price depending on the specific hardware. Options include:
 - i. Roam to another network via session persistence.
 - ii. Extend coverage through access point or base station technology deployments.

9. Mobile Building and Permitting

IBM will provide advisory consulting services up to 40 hours to the City of Miami Beach to determine the options to bring the permitting application into the field and onto the WiFi network.

10. WiFi-enabled Multi-space Parking Pay Stations

IBM will provide up to 100 hours of integration consulting support through to assist with bringing the parking meter solution onto the WiFi network. This includes such tasks as:

- a. Bench testing
- b. Integration into the terminal management system
- c. Field testing and validation of real time statistics
- d. Identification of work required to integrate the meters onto the wireless network

11. IBM Accessibility Technologies

IBM will provide a trial version and special pricing for a tool that is not commercially available to other organizations to improve accessibility of the Miami Beach web site. Capability includes:

- a. Downloadable software from the web site
- b. Unlimited number of users per web site
- c. Allows customizable color, sound effects
- d. Reads text aloud in 9 languages, with adjustable speed, volume control
- e. Purchase price: \$50,000 - \$60,000 Y1
- f. License and support services: \$16,000 - \$20,000 Y2 forward

12. Mobile Incident Command Trial

IBM will provide one NIMS 2.0 compliant Mobile Incident Command prototype for a trial period of 60 days.

Specifics of the trial include:

- a. 60 day trial duration
- b. One mobile hardware device, including, software, and support
- c. Solution is NIMS 2.0 compliant

13. Governmental and Packaged Solutions for Fixed Video and In-Car Video

The IBM team has developed comprehensive offerings for stationary and in-car

video capture for States and Local Governments. This includes digital video capture system, integration services, and data management software and hardware. Our offerings are backed by a team of skilled consultants and technologists to accomplish these complex solution objectives. We are well positioned to efficiently provide the equipment and related services to support the deployment of digital video system and the management of the video captured. In addition to our technology capabilities and knowledge, we have years of experience working with state and local law enforcement organizations nationwide.

- a. IBM will provide a free pilot the City of Miami Beach consisting of a 30 day trial for one car outfitted with one camera.
 - i. IBM will provide the server and storage required to capture up 6 hours of video at 15 frames per second. The video will be stored for 5 days during the pilot.
 - ii. One existing City of Miami Beach workstation will be set up to view the video.
 - iii. IBM will install the equipment in one City of Miami Beach vehicle.
 - iv. The City of Miami Beach will provide network connectivity for the server.
 - b. IBM has estimated the following pricing for future and potential Digital Video Solutions for Miami-Beach:
 - i. Stationary/Fixed Video --\$2,000-\$12,000 Per Camera (Minimum of 20 cameras)
 - OR -
 - ii. In-Car Digital Video--\$9,000 - \$10,000 Per Vehicle (Minimum of 20 vehicles)
 - iii. These estimates include all software and the server with internal storage based on the following assumptions:
 1. Mpeg 4 video is captured and stored at 15 frames per second using CIF (352x288) or QCIF2 (704x288) resolution (These are standard specifications in terms of format and quality for digital video surveillance.)
 2. A maximum of 6 hours of video is captured daily (A typical high end estimate is 2 hours of video per shift.)
 3. The video will be stored on the server for 30 days.
- For In-Car Video Solution the following assumptions and City of Miami Beach responsibilities apply:

1. The City of Miami Beach will utilize existing Mobile Data Terminals (i.e. laptops in vehicles) which have at least 5 GB of free space on their internal hard drive for storage.
2. IBM will determine whether the City's Mobile Data Terminals have the minimum requirements for the solution at the time of interest.
3. The video will only be stored on the Mobile Data Terminals for a maximum of 2 days before it is automatically uploaded to the storage server or manually transferred.

iv. These estimates are for budget and planning purposes only.

c. Storage Requirements Calculation Logic

- i. The following storage calculations provide the details incorporated into our estimates.

Server Storage							
#	Bit	#	of	#	of	Total	Total
Cameras	Rate	Hours		Days		MB	GB
20	512	6		30		829440	829.44
							0.82944

Mobile Data Terminal Storage							
#	Bit	#	of	#	of	Total	Total
Cameras	Rate	Hours		Days		MB	GB
1	512	6		2		2764.8	2.7648
							0.00276

14. Mobile Noise Complaint Inspection Pilot

IBM will provide a 60 trial of a hand held mobile noise complaint solution. Specifics of the trial include:

- a. Creation of one Noise Complaint Inspection Form
- b. 60 day trial to include evaluation software licenses
- c. One way upload to backend complaint system
- d. Data and forms are hosted at an ASP for trial period
- e. Hardware evaluation units can be arranged
- f. \$15,000 charge for pilot execution and support by IBM

15. Project Management Office

IBM's project management office consists of the following:

- a. Single Point of Contact (SPOC) through its project management office.
- b. Staffed by a senior PMI certified project manager
- c. An IT Architect
- d. Network Specialists
- e. Administrative support
- f. IBM advocates telecommuting, so this staff will not necessarily work from one physical location.
- g. IBM's project team including customer support and technical resources will report through the IBM Project Office to the IBM Project Manager.
- h. The IBM Project Manager will report directly to the City of Miami Beach's designated project manager for the wireless project.
- i. IBM will commit to utilizing network and office space at the Old City Hall location or a location to be determined with the City in order to provide a location for server hardware and physical work space for on the ground team members.
- j. Additionally, IBM may wish to work with the City to establish a physical office within the City of Miami Beach and will coordinate with the City to determine the details of such an arrangement. The local IBM team currently operates out of the Coral Gables facility where IBM has been based for the last 15 years.

16. Sponsorship Marketing and Marketing Support

IBM will coordinate a promotional campaign in conjunction with the City of Miami Beach to include:

- a. Press releases
- b. White papers
- c. Internal and external promotional pieces
- d. IBM will work with the City of Miami Beach to ensure the City is represented at business shows and trade fairs.
- e. IBM will collaborate with the City of Miami Beach to develop joint opportunities to host IBM Customer Executive Events.

- f. IBM will host one significant event each year in the City of Miami Beach.
- g. IBM will induct the City of Miami Beach into the Executive Contact Program, which creates strategic links between the top City officials and a senior IBM executive in order to showcase IBM Company and community activities, including initiatives and grants.

17. IBM Scripps Infectious Disease Research

On February 16, 2006, an announcement was made by IBM, Governor Jeb Bush, and Scripps to unveil the details of an exciting collaboration on pandemic research to be headquartered in South Florida. IBM and Scripps are already working on a similar project based in California in which over 200 million computational cycles have been generated and analyzed for HIV treatment research.

IBM invites the City to join forces with other governmental agencies who are participating in this project.

18. IBM Institute for Electronic Government

The City can showcase its technology at IBM's Institute for Electronic Government in Washington D.C. Since it opened in 1996, over 25,000 government leaders from around the world have visited the IEG for customized meetings, for tours of the 15,000 square feet of demonstration space, for collaboration and idea-exchange with their peers and IBM executives and staff who have deep experience in the business of state and local government. This is a win-win for IBM and for the cities that are featured at the IEG, IBM's briefing center dedicated to eGovernment.

Piggyback User Access

All entities approved by the City of Miami Beach are eligible to receive or utilize the City's contract pricing and terms and conditions. The City shall have no liability to IBM for the cost of any purchase made by an ordering entity and shall not be deemed to be a party thereto. IBM shall pay to the City of Miami Beach on a monthly basis, 1% of the total dollar amount of all sales to governmental, not for profit or quasi governmental entities, resulting from this contract and/or utilization of the City's contract, pricing, or terms and conditions.

PROPOSED AGREEMENT

The negotiated agreement will ensure that the City receives a “turnkey solution” and a “state of the art” system, consists of a wireless network covering all 7.1 square miles, and simple to maintain and inexpensive to upgrade with expansion to satisfy future needs for additional functionality and/or capacity. The proposed “system” will include:

- Network infrastructure procurement;
- Architecture and design services;
- Installation services;
- Telecommunications provisioning and services;
- Network monitoring and management services;
- Network maintenance and upgrade services;
- Operations Support Systems (OSS) services;
- Customer service and technical support services;
- Software hosting services; and
- Program and project management services.

IBM's system will support the following categories of service and will be flexible to accommodate new services over time.

Service Types	Definition	Examples
Secure Government Portable	Mobile access by City agency users using mobile computing devices	Public safety officers, inspectors, meter readers, surveyors, etc.
Secure Government Fixed	Fixed access for City devices in fixed locations	Parking meters, utility meters, cameras
Hot Zone Service	Free basic internet access for public access	Residents, tourists, business travelers

IBM's network will meet the following requirements.

- Support throughout the Coverage Area for wireless access from desktop PCs, laptop PCs, handheld devices, mobile phones and other manned or unmanned devices equipped with either an IEEE 802.11b or 802.11g (“Wi-Fi”) wireless interface.
- Support throughout the Coverage Area for “best-effort” service with an average net throughput per subscriber of one (1) megabit per second (Mbps) upstream (client device to network) and downstream (network to client device) transmission.
- 95% in-street (outdoor) coverage for the devices referenced above within the Coverage Area with no additional hardware required beyond the device's standard wireless interface.

- 70% in-building (indoor) coverage for residences and businesses within the Coverage Area. A residence or business is assumed covered under this requirement if a single, first or second-floor room, (e.g. adjacent to an exterior wall in the residence or business), can access the wireless network at the stated best-effort service levels.
- Support for having parks, common areas and other public spaces within the City defined and managed to allow any user with a mobile device to gain **free** and open access to the System while in these areas.
- Provide the infrastructure, deployment, management, software for **free** public access Citywide – **100% hot zone**.
- Battery and/or solar power backup for all network equipment sufficient to assure continuous operation at full power and functionality for a period of not less than one (1) hours in the absence of utility power. **The IBM proposed 2.4 GHz Tropos solution for meshing and access layer offers the advantage of built-in 8-10 hour back-up battery that can accommodate 480 volts of power on the streetlight poles in the South Beach area.**
- Support for a mixed wireless and wired “backhaul” solution to aggregate Wi-Fi network traffic from multiple subscribers and access points back to an Internet point of presence (“PoP”).
- Support for the use of City-owned structural assets, such as street light poles and utility poles or other assets which the City may provide access to.
- Support for pole, roof and wall mount options for wireless network equipment.
- Compliance to IP56/NEMA4 dust and water ingress ratings for all outdoor-mounted equipment.
- Support for ambient temperature ranges of 0 F to +122 F for all outdoor-mounted equipment.
- Support for all outdoor-mounted equipment to withstand wind loads up to 150 mph and consistent with any codes and/or regulations that may exist within the City of Miami Beach, with no impact to operation of the System.
- Protection against power surges, including lightning strikes, for all electrical and network connections.
- Support for the logical segmentation of the System to support different “domains” of users (e.g. secure access by government agency personnel, open access for public users, etc.). This will include the ability to define and manage different profiles for authentication, encryption and other service characteristics based on the requirements of each user domain.

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- Support for parks, common areas and other public spaces within the City defined and managed to allow any user with a mobile device to gain **free** and open access to the System while in these areas.
- Support for seamless, in-motion usage throughout the Coverage Area by government users. This includes the ability for subscribers to maintain "session-level" persistence while the subscriber's device is in motion at speeds up to sixty (60) miles per hour.
- Sufficient capacity throughout the System to support the subscriber projections defined by the City at the service levels described above throughout the contract term.
- Scalable to support additional users, capacity, and functions throughout the contract term.
- Support for both 32 bit (IPv4) and 128 bit (IPv6) IP Addressing, including multicast and anycast support.
- Support for the prioritization of network traffic for specific applications, users, devices, and domains.
- Fault tolerance mechanisms to mitigate and/or eliminate single points of failure for all components of the System.
- Guaranteed reliability of 99.9% for the 802.11g and 802.11b tier of the System and 99.999% for the backhaul and PoP tiers of the System.
- Support within any proposed fixed wireless backhaul solution to also provide advanced subscriber services beyond the level(s) of service available through the Wi-Fi tier of the System.
- Support for state-of-the-art security standards. These must include:
 - Physical security for all critical network equipment and other components of the System via secured facilities.
 - Support for Media Access Control ("MAC") address filtering.
 - Support for Wired Equivalent Privacy ("WEP") encryption, including both 64 and 128 bit keys.
 - Support for Temporal Key Integrity Protocol ("TKIP") encryption.
 - Support for Advanced Encryption Standard ("AES") encryption.
 - Support for Wi-Fi Protected Access ("WPA").
 - Support for 802.1x authentication using Extensible Authentication Protocol ("EAP") and "Remote Authentication Dial-In User Service" ("RADIUS").
 - Support for the suppression of Extended Service Set Identifier ("ESSID") broadcasts.
 - Support for multiple ESSIDs and the ability to map ESSIDs individually to Virtual LANs ("VLANs").

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- Support for filtering of traffic based on Internet Protocol ("IP") addresses, subnets and Transmission Control Protocol ("TCP") ports.
 - Support for Virtual Private Network ("VPN") tunneling.
 - Support for encryption of all control and network management traffic transmitted within the System.
- Support the ability to define and manage unilateral, inbound roaming relationships whereby subscribers to other Wi-Fi services (e.g. T-Mobile, Sprint) may gain access to the System over time to support evolving business models and opportunities.
- Support the ability to define and manage unilateral, outbound roaming relationships whereby subscribers to the System may gain access to other approved Wi-Fi services over time to support evolving business models and opportunities.

B. Architecture and Design Services

IBM has developed an overall architecture for the System, to include all network equipment, hardware, software and other components required to meet the following City requirements:

- The City's unique land area, geography, terrain, foliage, morphology (land use), structural mounting assets and other factors that may impact the performance, reliability or scalability of the System;
- Network equipment, hardware, software and other components proposed are to be integrated to meet the requirements defined in the RFP;
- Core business processes to be used throughout the System (e.g. call flow for customer service, billing cycles, trouble ticketing);
- Reliability requirements and service levels;
- All pre-installation site acquisition, site survey, propagation modeling and other work required to determine the configuration for all infrastructure components in the System;
- The tools and processes to be used for all post-installation testing and verification of performance, reliability and scalability for all parts of the Coverage Area;
- A detailed description of the deliverables to be provided to the City following the post-installation testing and verification process;
- A detailed Implementation Plan, Statement of Work, Project Schedule and Milestone Payment Schedule;
- A final "as built plan" for the network infrastructure, supplied in ESRI coverage (.e00) or shapefile format. All base mapping must be accurate to 1"=200' national mapping accuracy standards.

C. Installation Services

IBM will include the turnkey installation and configuration services required for the successful deployment of the System. This is to include, but not be limited to the following:

- The installation and configuration of all network components, access points, routers, bridges and other network equipment;
- Coordination with the City and any other parties required for access to any structural assets, facilities or permits required for the installation of the System;
- The ramp-up and activation of all services defined to include but not be limited to customer service, technical support, hosting, OSS, network management systems, processes and personnel;
- The configuration and integration of all components in the Systems to meet the requirements defined in the RFP;
- Adherence to any FCC rules or guidelines for the configuration and installation of any wireless equipment using licensed or unlicensed spectrum, with specific emphasis on Part 15 of Title 47 of the Code of Federal Regulations for unlicensed operation;
- Any tuning required throughout the contract term to meet the service level agreements ("SLAs") defined in the RFP; and
- A safety plan detailing precautionary measures taken to mitigate risks during installation.

D. Telecommunications Provisioning and Services

IBM will include a detailed description about network capacity estimates for aggregation points and maintenance services for any wired or wireless leased line telecommunications services needed to support their System throughout the contract term. This is to include, but not be limited to the following:

- A detailed description for how capacity estimates for all aggregation points in the System was derived. This description can use either or both of the following methods:
 - Concurrent subscriber bandwidth usage for each category of service referenced in Section I and subscriber projection defined in Section I of the RFP, expressed in kilobits per second (Kbps) per subscriber.
 - Oversubscription rates for each category of service referenced in Section I and subscriber projection defined in Section I of the RFP, expressed as a ratio of subscriber bandwidth sold to net aggregation-point bandwidth available.

E. Network Monitoring and Management Services

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IBM will include a turnkey solution for the monitoring and management of the System. This will include all network equipment, hardware, software, tools, personnel and other components required to meet the reliability and performance goals established in the contract.

F. Security Management

IBM will control access to network and system resources according to defined policies so that the network cannot be sabotaged (intentionally or unintentionally) and those without appropriate authorization cannot access sensitive information.

In addition to supporting the five functional areas listed above, IBM's System will meet the following technical requirements:

- Support for event notifications;
- Support for group management of system components;
- Built-in configuration database;
- Support for Simple Network Management Protocol ("SNMP") standards;
- Graphical representation of network data;
- Support for configurable Access Control Lists ("ACLs");
- Ability to drill-down on System components;
- Ability to auto discover new devices in the System;
- Support for wireless proxy agents for non-SNMP devices;
- Support for statistical reporting;
- Support for remote management and updates of remote system components from a central location;
- Compatible with end point CSA client for remote users; and
- Compatible with City's existing network management software suites CiscoWorks Version 5.5 and SolarWinds Version 8.0.

G. Network Maintenance and Upgrade Services

IBM will include routine maintenance of the System. This will include spare inventory, upgrade cycles, capacity upgrades, or similar needs. IBM's System will also mitigate the risk of obsolescence in the System over time. IBM will continuously upgrade the System during the contract term. Proposals will install new nodes on as-needed basis during the entire contract term to support additional capacity requirements if necessary.

IBM will maintain the System as the best of the best Citywide wireless network. IBM will provide a complete replacement of the network infrastructure during the term of the agreement. Additionally, IBM will comply with the following:

- An upgrade plan must be submitted in advance of any planned update, subject to review and approval by the City;
- Minimal interruption of service can occur during these upgrades;
- Backwards compatibility must be provided for existing applications, services and subscribers as upgrades occur; and

- Upgrade plans will consider the specific product roadmap for the equipment vendor(s).

H. WiMax Upgrade Backhaul Capacity Injection

A key part of this technology refresh is the introduction of WiMax standard equipment into the backhaul portions of the network. Prior to the adoption of 802.16e (WiMax mobility), WiMax is envisioned as a fixed wireless high capacity link capability. This makes it a perfect alternative to getting high speed links to fixed locations, such as backhaul or endpoint buildings. In order to get the most out of the investment in additional hardware and associated labor, the WiMax technologies will be overlaid onto the backhaul network. This overlay will effectively double the backhaul capacity of the network from the proposed 200 Mbps to 400 Mbps.

I. Backbone and Mesh Capacity

The System will support 250,000+ subscribers; 26,000 active users; and 15,625 simultaneous users.

J. Scenario that Potentially Reduces Pole Count

As part of IBM's research to expedite deployment in the face of limited mounting assets, IBM has looked at some additional technologies. There are a few different options for base station deployments in the 2.4 GHz frequency that provide high power output and directed signals, effectively increasing the coverage. Given this, there are base station options to consider where there is limited pole infrastructure available today. IBM will test and potentially use base station technology to augment coverage in those areas, such as Middle Beach, that are challenged with limited pole infrastructure. This scenario potentially would save the City up to \$200,000.

K. Operations Support Systems (OSS) Services

IBM will provide a turnkey solution for an Operations Support System ("OSS") that integrates all customer service, technical support, provisioning, network element and network management components as seamlessly as possible. Specific requirements include, but are not limited to the following:

- The ability to support flexible service policies for time and for quality of service;
- The design, development, management and hosting of a subscriber software portal for the System;
- The portal must also support multi-lingual usage;

- The ability to support co-branding of the portal;
- The ability to define basic access and other value added service plans for evolving business model opportunities over time;
- The ability to perform usage tracking, customer reporting and usage policy enforcement; and
- Interoperability with RADIUS-based public access points and gateways.

L. Customer Service and Technical Support Services

IBM will include a turnkey solution for “tier-one” customer service and technical support via a call center or other mechanism for public access hot zones and “tier-two” customer service and technical support via a call center or other mechanism for government users. Tier-one service refers to the diagnosis and resolution of issues identified by public users at hot zone locations throughout the City. Tier-two service refers to the diagnosis and resolution of issues identified by the City’s IT department help desk that provides tier-one support to government users.

The City has committed to provide tier-one customer service and technical support to government users only, meaning that the City’s IT help desk will be the “first line of defense” for government subscribers on the network. Specific tier-two requirements that must be met by IBM include:

- Issues from tier-one City IT help desk agents dealing with technical problems reported by government subscribers (technical support issues);
- A toll free 1-800 number for the City IT help desk to contact IBM in order to report an issue and obtain a resolution;
- Tier-two support hours are expected to be 24x7x365;
- Proactive notification to the City for network problems, outages and other issues affecting the System via e-mail and Web interface;
- The development, maintenance and hosting of a library containing electronically available frequently asked questions (“FAQ”) to aid in self-support;
- A secure, managed database of City call tracking detail, resolutions, etc. This System should be fault tolerant and backed up on a regular schedule. The System should also support secure login to private areas by the City and include a system to retain all relevant documents for a period of at least two (2) years;
- The creation and routine delivery of pre-defined and ad-hoc reports on issues, wait times, abandoned calls, resolution times and other standard customer service and technical support metrics;
- While no “warm transfer” of subscriber issues will be escalated from City agents, IBM will support “three-party calls” with the IBM’s agent, City agent

and subscriber to diagnose and resolve an issue. City IT Help Desk agents will be required to retain ownership of the subscriber call;

- The ability to support "total call management", referring to the diagnosis and resolution throughout the lifecycle of a subscriber or City agent issue.

This will include the ability to track a call from the time the issue is reported through any escalation to other parties, and the closed-loop resolution with the City agent.

M. Software Hosting and Facilities Services

IBM will be responsible for hosting the splash page/portal for the public access hot zones. IBM has included all costs and detail for the following facilities-related services:

- Backup and recovery tools and processes;
- Proactive capacity planning; and
- Problem avoidance and change management tools and processes.

N. Program and Project Management Services

IBM will provide program and project management services throughout the contract term. Specifically, these services will include:

- The designation of a Project Manager who has the authority to make key financial, legal, operational and other decisions required for compliance with the contract terms;
- The designation of a primary or single point of contact ("SPOC") from IBM for all business and technology-related issues;
- The delivery of routine program and project status reports to the City. These status reports must include:
 - Date of report
 - Summary of program and/or project status
 - Items completed during last reporting period
 - Items planned for next reporting period
 - Issues and risks identified
 - Mitigating factors for issues and risks identified
 - Project schedule, timeline, tasks, owners
 - SLA compliance status for prior reporting period
 - Other issues as deemed appropriate or required by the City; and
- The designation of an issue escalation path, which is to include the names and contact information of personnel from the SPOC to the executive

sponsor, the types of issues requiring escalation, timeframes, and other parameters.

O. Maintenance and Support Services

IBM will provide a one-year (1) maintenance/support services, commencing on final acceptance of the System and project by the City. Maintenance and support will be furnished on a "turnkey" basis. IBM will be contractually responsible for all maintenance and support services for all elements of the System, including but not limited to all equipment and software and any data transport services that are required under the contract, and will be the single point of contact for service and support.

P. Warranty

IBM warranty will cover the entire Wireless Miami Beach System and all work that is provided by IBM under the contract, including, without limitation: all software, equipment, cabling, and other deliverables; network design and other designs and studies furnished and/or used in the implementation of the System; and implementation/integration services, construction services, and any other services required under the contract.

IBM's warranty will guarantee that the System will conform to the contract statement of work and to all technical specifications, performance standards, and designs for the System that are incorporated in the contract and/or furnished as deliverable under the contract. The warranty must be on a "turnkey" basis – IBM will be responsible for all warranty obligations and must be the single point of contact for service under the warranty. The warranty period is two (2) years, commencing on final acceptance of the System by the City.

Q. Training

IBM will provide the following training services:

- Two (2) weeks of informal training on the design and operation of the overall System for a minimum of four (4) City-designated persons prior to the activation of the network;
- Minimum of one (1) week of updated informal training on the design and operation of the overall System for a minimum of four (4) City-designated persons on an annual basis during the contract term;

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R. Project Schedule

IBM's project deployment schedule we will be able to accomplish the City's goal to have the wireless deployment completed during the summers of 2006. IBM will work closely with the City of Miami Beach to identify the amount of resources and will present the schedule that the City of Miami Beach will meet in order for IBM to maintain its project schedule. Together, the City and IBM anticipate completion of the citywide wireless network by summer 2006.

There are five phases defined in the plan below. Most major tasks have been "fast tracked" or have been scheduled to run in parallel with their predecessors instead of having a "Start to Finish" relationship. In order to accomplish this, IBM will introduce additional resources than previously planned to expedite the schedule and meet the City's desired schedule. There are a total of four engineering/design teams and four deployment teams scheduled. IBM will work with the City to adequately identify the required City resources to execute this schedule and identify contingency plans to ensure a timely completion.

Detailed Project Plan and Milestones

The planned methodology is to build out the backbone first and deploy the hot zones as defined in the RFP as the first priority in order to provide access to the public users. These deployments will provide the most immediate benefits to the public and as such have been treated as a priority. Since these hot zones are distributed throughout the geography of the City, the base infrastructure remaining (including the backbone and backhaul) required to deploy the areas will be established and the rest of the deployment can be expedited as well.

Letters of Credit

IBM will provide the City with two (2) Letters of Credit: 1) \$250,000 Letter of Credit as required by the RFP; and 2) Letter of Credit to cover the build period capital and build expenses as follows:

- a. IBM commits to the City of Miami Beach that it will put in place a letter of credit to cover build costs within 15 days of contract award.
- b. The letter of credit escalates as milestone payments are made to cover the total expenditures to date.
- c. Final acceptance of the build phase removes the letter of credit.
- d. There will be a well defined binding escalation process with cure periods.

CITY MANAGER'S REVIEW

The City Manager was briefed on the results of the contract discussions; the best and final offers submitted by both IBM and WFI; the results of the pilot testing, the public benefits offered by IBM; and the terms and conditions of the proposed agreement

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between the City and IBM as prepared by Leibowitz and Associates in coordination with our City Attorney's Office. Having exercised his due diligence, the City Manager concurs that IBM's system and offer represents the best value for the City.

It is important to reiterate the goal of the City's WiFi project -- to use wireless broadband technology to increase government efficiency in delivery of services, and provide an unprecedented level of access to City residents and visitors.

The City specifically plans to use wireless broadband technology to support:

- Public safety mobile access Citywide;
- Mobile access for other Miami Beach government agencies;
- Hot zone access for targeted commercial areas; and

- Recurring cost savings for internal government network use.

The City proposes to capitalize on this potential by leading an effort to create a wireless network that will provide high-speed, broadband wireless connectivity to all points within the City.

The benefits of making this technology investment are broad and far reaching. First and foremost, the City should embrace this initiative if it is to remain a competitive location for business, a world-class center for entertainment, and a destination for visitors. Wireless access is fast becoming the indispensable tool of the leisure or business visitors.

Currently the City uses cellular air card services for wireless or mobile applications. These services are provided by third party vendors at a fixed monthly cost per device. Using a City-owned WiFi network, the City will be able to add additional wireless applications without increasing the annual operating and maintenance cost for the WiFi network.

Today, visitors are demanding access to travel information and are using mobile devices to make all types of arrangements when traveling. Visitors expect to be able to look up maps and get directions, find retail shops and read restaurant reviews while they sit at the beach, dine on Lincoln Road or drive throughout our City. Citywide wireless access will become an essential component of a successful strategy to continue to strengthen the hospitality sector of our economy.

Additionally, it is an essential investment to enhance the quality of life for our residents and to support the delivery of public services. For the past few years, we have used information technology and the Internet to transform how government business is done, how services are delivered and how the City interacts with residents, business and visitors.

Now, the City is aggressively pursuing wireless technology to improve service delivery and to reduce costs in many applications, from mobile data computers in police cars, to handheld devices that give service delivery workers an office in the field. In the near future, this wireless access, when implemented throughout the City, will permit expanded mobile applications for City employees as well as enable enhanced service delivery for applications such as wireless water meter reading and validated credit card transactions at parking pay stations.

The City has embraced this new technology and has established a goal to use wireless broadband technology to increase government efficiency in delivery of services, and provide a basic level of access to City residents and visitors through free hot zones.

CONCLUSION

The Administration recommends that the Mayor and City Commission of the City of Miami Beach, Florida, approved the Agreement between IBM and the City, for the Design, Deployment, and Management of a Citywide Wireless Network (Wi-Fi); in the base estimated amount of \$4,498,800, which includes the cost for the network infrastructure, architecture and design services, installation, and six (6) years of operation, maintenance, project management, support and warranty services; option no. 2 for a 100% citywide access in the estimated amount of \$669,000; project contingency in the amount of \$248,771; and acceptance of public benefits offered by IBM; further authorizing the Mayor and City Clerk to execute an Agreement with IBM; and further appropriating funds in the amount of \$1,886,652 from the Information and Communication Technology Fund.

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DRAFT WIRELESS SYSTEM AND SERVICE AGREEMENT - TERM SHEET

Parties: City of Miami Beach and International Business Machines Corporation (Vendor).

Scope of Agreement: Vendor shall provide, operate and maintain for the City a WiFi Network including but not limited to all design, construction, installation, support and maintenance of Equipment, Software and Services necessary to make available free access to the Internet from any point within the City on a "Turnkey" basis.

Price and terms of Payment:	Capital Cost	\$1,505,669
	Operating & Maintenance	
	Year 1	\$528,849
	Year 2	\$592,439
	Year 3	\$627,610
	Year 4	\$638,334
	Year 5	\$664,450
	Year 6	<u>\$610,449</u>
		<u>\$3,662,131</u>

Total Cost	\$5,167,800
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Capital cost will be paid in five 20% payments.
Operating cost for each year will be paid in quarterly installments.

Term: The initial term will include the period of design, construction, installation and testing of the System and six (6) years from the Acceptance Date of the System. The City, at its sole option and discretion, may renew the term of the agreement for two (2) additional three (3) year terms.

System Design: Vendor shall employ a methodical approach to Network design that centers around three progressively elaborated levels of granularity and detail. The Network architecture shall have the capability to evolve as the City's needs evolve thereby enabling the development of a progressively more detailed set of Network designs, each meeting the full set of functional requirements.

Network Infrastructure Requirements: The System shall consist of a wireless Network covering all 7.1 square miles of the City of Miami Beach, including that portion of Terminal and Fisher Islands that is within the City. [we should add capacity here]

Network Monitoring and Management Services: Vendor shall be responsible for monitoring and managing the System, including but not limited to all Network Equipment, Hardware, Software, Tools, Utilities, Internet connectivity, personnel and other components required to meet the reliability and performance goals of the City throughout the term of this Agreement

Remote Operations Center: Vendor shall utilize a remote operations center. Designated City Personnel shall at all times have access to all Network management software.

Reports: Vendor shall provide the City a written report regarding Network management, monitoring and maintenance on a quarterly basis or within ten (10) calendar days of any City request for the same.

Maintenance and Support Services: Vendor shall provide six (6) years of maintenance/support Services at no additional cost to the City. Vendor shall be responsible for all maintenance and support Services for all elements of the System, including but not limited to all Equipment and Software and any data transport Services that are required under the Agreement, and will be the single point of contact for Maintenance, Service and Support.

Prioritization of Access and In Motion Service: Vendor's System shall ensure first right of access to government users. Vendor shall provide seamless, in-motion connectivity throughout the Coverage Area to government users. This includes the ability for Subscribers to maintain session-level persistence while the subscriber's device is in motion at speeds up to sixty (60) miles per hour. This capability must be supported with no interruption to applications running on the device. Vendor shall provide to the City 600 NetMotion licenses for use by the City.

System Security:

The System shall provide State of the Art security creating a means of authenticating users and a secure 802.1X or VPN method for securely connecting to the Network. Vendors shall use best efforts to install any security or encryption patches or updates on an expedited basis, but in no event shall this period exceed forty-eight (48) hours from the release of any such update. These security standards shall include but not be limited to the Encryption standard protocols and the Florida Department of Justice Security Standards.

Encryption:

Vendor shall design and provide State of the Art security and encryption solutions for the Network, particularly for City users, which includes but shall not be limited to the physical security for all critical Network Equipment and other components of the System via secured facilities. The Vendor agrees to provide solutions and support for the following as well as new security or encryption protocols as they become commercially available.

Network Filter:

Vendor shall provide State of the Art Network security, capable of dynamically identifying possible security breaches, actively tracing the root thereof and immediately taking corrective action. Support for State of the Art Network traffic monitoring, analysis and reporting capable of capturing and analyzing all traffic transport over the System and decoding all major TCP/IP and application protocols in order to filter Network traffic to find specific information.

Technical and Customer Support:

Vendor shall provide technical and customer support for the System.

Training:

(a) Vendor shall provide training for a minimum of two (2) weeks of training on the design and operation of the overall System for a minimum of four (4) City-designated persons prior to the activation of the System.

(b) Vendor shall provide a minimum of one (1) week of updated informal training on the design and operation of the overall System for a minimum of four (4) City-designated persons on an annual basis during the term.

Construction and Activation Schedule:

Vendor shall timely construct and implement the Network. Vendor is on notice that time is of the essence for compliance with this Agreement. It is the Parties' intent that the System be designed, constructed and made operational on an expedited basis. Expected operational date is summer 2006.

Ownership and title to Equipment:

Title to all components of the System including but not limited to, Equipment and Software installed pursuant to this Agreement shall be exclusively held by the City, free and clear of all liens and encumbrances. All warranties, guarantees and licenses associated with any Equipment or Software used in connection with the System shall be assigned to the City.

Upgrade and State of the Art System:

Vendor shall maintain a State of the Art System as defined in Section I, 1.10 herein during the term of the Agreement to mitigate the risks of obsolescence in the system or its performance. It is Parties' intent to maintain the system as the best of the best citywide wireless network. Vendor shall provide to the City, at a minimum, on an annual basis, a written report setting forth the then current State of the Art for wireless Networks and Services, including but not limited to; (a) requirements to upgrade the System to enhance the existing level of Services and applications; and (b) to provide any new wireless Services or new products commercially available. Based upon the findings of the report, Vendor shall simultaneously submit an upgrade plan to the City which shall include a description of new Software, Equipment and Services the Vendor shall provide and the timing for implementation of the new Software, Services and Equipment on a commercially reasonable expedited schedule. The Parties contemplate that one complete replacement of the network infrastructure shall be

provided during the term of this Agreement. Additionally, Vendor warrants that: (i) there will be minimal interruption of Service during upgrades; (ii) backwards compatibility will be ensured for all existing applications, Services and Subscribers as upgrades occur. State of the art is defined as the most advanced, commercially available, Wireless Fidelity (WiFi) and Worldwide Interoperability for Microwave Access (WiMax) technology solutions related to levels of performance, Applications, Equipment, Software and components, based upon ratified standards issued by the Institute of Electrical and Electronic Engineers, Inc. (IEEE), to enhance existing or potential user applications for the City and/or the Network users taking in consideration performance, Capacity, signal coverage, reliability, features, maintenance, and efficiency of frequency use. The Parties anticipate that upgrades, including WiMax, under consideration by the industry, will be deployed by Vendor on an expedited basis when commercially available. For the purposes of this Agreement, State of the Art shall mean the most advanced, commercially available, Wireless Fidelity (WiFi) and Worldwide Interoperability for Microwave Access (WiMax) technology solutions related to levels of performance, Applications, Equipment, Software and components, based upon ratified standards issued by the Institute of Electrical and Electronics Engineers, Inc. (IEEE), to enhance existing or potential user applications for the City and/or the Network users taking in consideration, performance, Capacity, signal coverage, reliability, features, maintenance and efficiency of frequency use. State of the Art shall not include any technology or Equipment which is in Beta stage.

Warranties:

Details to be provided by IBM.

Equipment Warranty:

Software Warranty:

- Insurance:** Vendor shall obtain, provide and maintain during the term of the Agreement the City's standard types and amounts of insurance which shall be maintained with insurers licensed to sell insurance in the State of Florida and have a B+ VI or higher rating in the latest edition of AM Best's Insurance Guide. Vendor is responsible for providing windstorm coverage for equipment and network components.
- Independent Vendor Relationship:** Vendor shall install the System and perform the Services required under this Agreement as an independent Contractor.
- Subcontracting Prohibited:** Vendor is prohibited from subcontracting this Agreement or any part thereof unless such subcontracting is first approved by the City in writing. A list of pre-approved sub-contractors is attached.
- Letter of Credit:** The Letter of Credit shall be in the amount of \$250,000 as a guarantee to the City of the completion and performance of the work, as well as full payment of all suppliers, laborers, or subcontractors employed pursuant to this Agreement.
- Construction Letters of Credit:** The Letter of Credit shall be an amount equal to the amount of each payment made by City as a guarantee to the City of the completion and performance of the work, as well as full payment of all suppliers, laborers, or subcontractors employed pursuant to this Agreement.
- Public Benefits:** The Vendor shall provide the public benefits related to the System. [build up]
- City Obligations:** The City shall be required to provide Vendor City assets and personnel to assist in the installation and upgrade of the System. [add specifics]
- Most Favored Nations - Technology, Services and Costs:** If, after this Agreement is entered into, Vendor enters into an Agreement, with another municipality, city or local government for the

provision of Wi-Fi or WiMax Services, technology or Equipment that provide better Services, applications or benefits or provides similar services as provided to City at a lower cost as reasonably determined by the City, the City shall have the right to amend this Agreement to include rights, obligations and benefits substantially similar to those contained in such other agreement.

DRAFT WIRELESS SYSTEM AND SERVICE AGREEMENT - TERM SHEET

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Total Cost	\$5,167,800
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Remote Operations Center: Vendor shall utilize a remote operations center. Designated City Personnel shall at all times have access to all Network management software.

Reports: Vendor shall provide the City a written report regarding Network management, monitoring and maintenance on a quarterly basis or within ten (10) calendar days of any City request for the same.

Maintenance and Support Services: Vendor shall provide six (6) years of maintenance/support Services at no additional cost to the City. Vendor shall be responsible for all maintenance and support Services for all elements of the System, including but not limited to all Equipment and Software and any data transport Services that are required under the Agreement, and will be the single point of contact for Maintenance, Service and Support.

Prioritization of Access and In Motion Service: Vendor's System shall ensure first right of access to government users. Vendor shall provide seamless, in-motion connectivity throughout the Coverage Area to government users. This includes the ability for Subscribers to maintain session-level persistence while the subscriber's device is in motion at speeds up to sixty (60) miles per hour. This capability must be supported with no interruption to applications running on the device. Vendor shall provide to the City 600 NetMotion licenses for use by the City.

System Security:

The System shall provide State of the Art security creating a means of authenticating users and a secure 802.1X or VPN method for securely connecting to the Network. Vendors shall use best efforts to install any security or encryption patches or updates on an expedited basis, but in no event shall this period exceed forty-eight (48) hours from the release of any such update. These security standards shall include but not be limited to the Encryption standard protocols and the Florida Department of Justice Security Standards.

Encryption:

Vendor shall design and provide State of the Art security and encryption solutions for the Network, particularly for City users, which includes but shall not be limited to the physical security for all critical Network Equipment and other components of the System via secured facilities. The Vendor agrees to provide solutions and support for the following as well as new security or encryption protocols as they become commercially available.

Network Filter:

Vendor shall provide State of the Art Network security, capable of dynamically identifying possible security breaches, actively tracing the root thereof and immediately taking corrective action. Support for State of the Art Network traffic monitoring, analysis and reporting capable of capturing and analyzing all traffic transport over the System and decoding all major TCP/IP and application protocols in order to filter Network traffic to find specific information.

Technical and Customer Support:

Vendor shall provide technical and customer support for the System.

Training:

(a) Vendor shall provide training for a minimum of two (2) weeks of training on the design and operation of the overall System for a minimum of four (4) City-designated persons prior to the activation of the System.

(b) Vendor shall provide a minimum of one (1) week of updated informal training on the design and operation of the overall System for a minimum of four (4) City-designated persons on an annual basis during the term.

Construction and Activation Schedule:

Vendor shall timely construct and implement the Network. Vendor is on notice that time is of the essence for compliance with this Agreement. It is the Parties' intent that the System be designed, constructed and made operational on an expedited basis. Expected operational date is summer 2006.

Ownership and title to Equipment:

Title to all components of the System including but not limited to, Equipment and Software installed pursuant to this Agreement shall be exclusively held by the City, free and clear of all liens and encumbrances. All warranties, guarantees and licenses associated with any Equipment or Software used in connection with the System shall be assigned to the City.

Upgrade and State of the Art System:

Vendor shall maintain a State of the Art System as defined in Section I, 1.10 herein during the term of the Agreement to mitigate the risks of obsolescence in the system or its performance. It is Parties' intent to maintain the system as the best of the best citywide wireless network. Vendor shall provide to the City, at a minimum, on an annual basis, a written report setting forth the then current State of the Art for wireless Networks and Services, including but not limited to; (a) requirements to upgrade the System to enhance the existing level of Services and applications; and (b) to provide any new wireless Services or new products commercially available. Based upon the findings of the report, Vendor shall simultaneously submit an upgrade plan to the City which shall include a description of new Software, Equipment and Services the Vendor shall provide and the timing for implementation of the new Software, Services and Equipment on a commercially reasonable expedited schedule. The Parties contemplate that one complete replacement of the network infrastructure shall be

provided during the term of this Agreement. Additionally, Vendor warrants that: (i) there will be minimal interruption of Service during upgrades; (ii) backwards compatibility will be ensured for all existing applications, Services and Subscribers as upgrades occur. State of the art is defined as the most advanced, commercially available, Wireless Fidelity (WiFi) and Worldwide Interoperability for Microwave Access (WiMax) technology solutions related to levels of performance, Applications, Equipment, Software and components, based upon ratified standards issued by the Institute of Electrical and Electronic Engineers, Inc. (IEEE), to enhance existing or potential user applications for the City and/or the Network users taking in consideration performance, Capacity, signal coverage, reliability, features, maintenance, and efficiency of frequency use. The Parties anticipate that upgrades, including WiMax, under consideration by the industry, will be deployed by Vendor on an expedited basis when commercially available. For the purposes of this Agreement, State of the Art shall mean the most advanced, commercially available, Wireless Fidelity (WiFi) and Worldwide Interoperability for Microwave Access (WiMax) technology solutions related to levels of performance, Applications, Equipment, Software and components, based upon ratified standards issued by the Institute of Electrical and Electronics Engineers, Inc. (IEEE), to enhance existing or potential user applications for the City and/or the Network users taking in consideration, performance, Capacity, signal coverage, reliability, features, maintenance and efficiency of frequency use. State of the Art shall not include any technology or Equipment which is in Beta stage.

Warranties:

Details to be provided by IBM.

Equipment Warranty:

Software Warranty:

Insurance:

Vendor shall obtain, provide and maintain during the term of the Agreement the City's standard types and amounts of insurance which shall be maintained with insurers licensed to sell insurance in the State of Florida and have a B+ VI or higher rating in the latest edition of AM Best's Insurance Guide. Vendor is responsible for providing windstorm coverage for equipment and network components.

Independent Vendor Relationship: Vendor shall install the System and perform the Services required under this Agreement as an independent Contractor.

Subcontracting Prohibited:

Vendor is prohibited from subcontracting this Agreement or any part thereof unless such subcontracting is first approved by the City in writing. A list of pre-approved sub-contractors is attached.

Letter of Credit:

The Letter of Credit shall be in the amount of \$250,000 as a guarantee to the City of the completion and performance of the work, as well as full payment of all suppliers, laborers, or subcontractors employed pursuant to this Agreement.

Construction Letters of Credit:

The Letter of Credit shall be an amount equal to the amount of each payment made by City as a guarantee to the City of the completion and performance of the work, as well as full payment of all suppliers, laborers, or subcontractors employed pursuant to this Agreement.

Public Benefits:

The Vendor shall provide the public benefits related to the System. [build up]

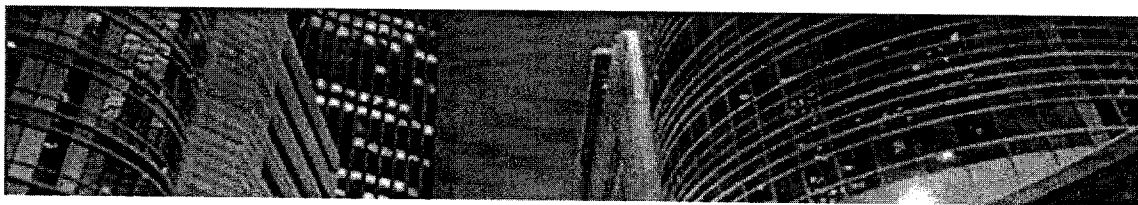
City Obligations:

The City shall be required to provide Vendor City assets and personnel to assist in the installation and upgrade of the System. [add specifics]

Most Favored Nations - Technology, Services and Costs:

If, after this Agreement is entered into, Vendor enters into an Agreement, with another municipality, city or local government for the

provision of Wi-Fi or WiMax Services, technology or Equipment that provide better Services, applications or benefits or provides similar services as provided to City at a lower cost as reasonably determined by the City, the City shall have the right to amend this Agreement to include rights, obligations and benefits substantially similar to those contained in such other agreement.



Municipal Wi-Fi Pilot Test Report

City of Miami Beach

February 21, 2006

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This report discusses the results of testing the municipal wireless network pilot systems installed within the City of Miami Beach, Florida. This testing was done to assess each system's ability to support technical requirements defined in the City's *RFP 36-04/05 for Citywide Wireless Network*.

1. Pilot Systems

This section describes the pilot system installations that were part of the testing:

1.1 IBM Solution

The IBM system includes 23 Tropos mesh nodes distributed throughout approximately a half square mile portion in the South Beach area. Four of these nodes are gateways with a 5.3GHz Alvarion backhaul link to the headend. The Tropos mesh nodes have a single-radio design that uses 2.4GHz 802.11b/g radios for both backhaul between mesh nodes and user access.

1.2 WFI Solution

The WFI system includes 16 Cisco mesh nodes distributed throughout approximately a half square mile portion in the North Beach area. Two of these nodes are gateways with a 5.3GHz Alvarion backhaul link to the headend. Figure 1 illustrates the location of each mesh node. The Cisco mesh nodes have a dual-radio design that uses a 5GHz 802.11a radio for backhaul between mesh nodes and a different 802.11b/g radio for user access.

2. Test Team

Wireless-Nets, Ltd. was contracted by Civitium to perform the testing for the City of Miami Beach:

- **Jim Geier:** Developed the test plan and led the testing efforts for the IBM and WFI pilot systems.

Jim is the founder of Wireless-Nets, Ltd. and the company's principal consultant. His 20 years of experience includes the analysis, design, software development, installation, and support of numerous wireless network-based systems for enterprises, airports, homes, retail stores, manufacturing facilities, warehouses, hospitals, and cities worldwide. Jim is the author of several books, including *Deploying Voice over Wireless LANs* (Cisco Press), *Wireless Networks* (Cisco Press), *Wireless LANs* (SAMS), *Certified Wireless Analysis Professional (CWAP) Study Guide* (Planet3), *Wireless Networking Handbook* (Macmillan), and *Network Reengineering* (McGraw-Hill). He has been active within the Wi-Fi Alliance, responsible for certifying interoperability of 802.11 (Wi-Fi) wireless LANs. He has also been an active member of the IEEE 802.11 Working Group, responsible for developing international standards for wireless LANs. He served as Chairman of the IEEE Computer Society, Dayton Section,

and Chairman of the IEEE International Conference on Wireless LAN Implementation. Jim is an advisory board member of several leading wireless LAN companies. Jim's education includes a bachelor's and master's degree in electrical engineering and a master's degree in business administration.

- **Eric Geier:** Assisted with the testing of the IBM and WFI pilot systems.

Eric is an associate consultant of Wireless-Nets, Ltd., where he analyzes wireless LAN technologies and products and performs RF site surveys for clients. Eric is a Certified Wireless Network Administrator (CWNA) and completed numerous wireless LAN protocol and RF propagation tests as part of the development of the Certified Wireless Analysis Professional (CWAP) Study Guide published by Planet3 Wireless. Eric has developed computer-based training on wireless LAN topics and is the author of several books, including *Wireless Networks – 5 Minute Fixes* (Wiley) and *PCs – 5 Minute Fixes* (Wiley). Eric is currently writing a book for Cisco Press on deploying public Wi-Fi hotspots.

3. Test Schedule

The test team performed testing on the following dates:

- IBM System – January 30–31, 2006
- WFI System – February 1–2, 2006

The testing was accomplished between the hours of 9 a.m. and 8 p.m. each day. There was occasional very light rain on most of the days, but this had no significant impact on test results.

4. Summary of Test Results

Table 1 summarizes the results of testing the IBM system.

Table 1. Test Results of the IBM System

Test Criteria	Criteria Satisfied?
Support for users equipped with either IEEE 802.11b or 802.11g wireless interfaces using various security methods (WEP, TKIP, AES, and WPA).	YES
95% coverage in the streets and sidewalks for users within the pilot test area.	YES
95% coverage throughout parks, common areas and other public spaces.	YES
70% coverage for users within residences and businesses within the pilot test area. This includes first or second-floor rooms adjacent to an exterior wall of the facility).	YES
Average net data throughput per subscriber of one 1Mbps (upstream and downstream) throughout the covered areas – measured against any point in the system.	YES
Sufficient capacity of the system to support 676 subscribers per square mile throughout the pilot test coverage areas. This is based on the requirement to support 4,800 subscribers as stated in the RFP over the entire 7.1 square mile city.	YES
Support for seamless, in-motion usage (up to 60mph) throughout the coverage areas with no interruption to applications running on the user device.	NO
Battery and/or solar power backup for all network equipment sufficient to assure continuous operation at full power and functionality for a period of not less than one (1) hour in the absence of utility power.	YES

Table 2 summarizes the results of testing the WFI system.

Table 2. Test Results of the WFI System

Test Criteria	Criteria Satisfied?
Support for users equipped with either IEEE 802.11b or 802.11g wireless interfaces using various security methods (WEP, TKIP, AES, and WPA).	YES
95% coverage in the streets and sidewalks for users within the pilot test area.	YES
95% coverage throughout parks, common areas and other public spaces.	YES
70% coverage for users within residences and businesses within the pilot test area. This includes first or second-floor rooms adjacent to an exterior wall of the facility).	YES
Average net data throughput per subscriber of one 1Mbps (upstream and downstream) throughout the covered areas – measured against any point in the system.	YES
Sufficient capacity of the system to support 676 subscribers per square mile throughout the pilot test coverage areas. This is based on the requirement to support 4,800 subscribers as stated in the RFP over the entire 7.1 square mile city.	YES
Support for seamless, in-motion usage (up to 60mph) throughout the coverage areas with no interruption to applications running on the user device.	NO
Battery and/or solar power backup for all network equipment sufficient to assure continuous operation at full power and functionality for a period of not less than one (1) hour in the absence of utility power.	YES

5. Procedures and Findings

This section of the report describes how the testing was done for each criterion and provides related findings and analysis.

5.1 Connection Testing

The connection testing assessed the following test criterion:

Support users equipped with either IEEE 802.11b or 802.11g wireless interfaces using various security methods (WEP, TKIP, AES, and WPA).

The test team successfully connected to a mesh node on the IBM and WFI pilot systems using a laptop equipped with an Orinoco Gold 802.11b/g radio card configured as follows:

- 802.11b-only with no security enabled
- 802.11b/g with no security enabled
- 802.11b/g configured with WEP
- 802.11b/g configured with WPA

The test team observed a packet trace of the communications taking place during the association process between the laptop and the mesh node for each of the above configurations. There was no abnormal protocol behavior during the association processes.

5.2 Signal Coverage Testing

The signal coverage testing assessed the following test criteria:

95% coverage in the streets and sidewalks for users within the pilot test area.

95% coverage throughout parks, common areas and other public spaces.

70% coverage for users within residences and businesses within the pilot test area. This includes first or second-floor rooms adjacent to an exterior wall of the facility).

The test team assumed that signal coverage exists where it is possible to connect to the wireless network with a common user device, such as a laptop, at a minimum data rate of 1Mbps and utilize typical applications, such as web browsing, email, and file transfer.

The signal coverage testing included the following for the IBM and the WFI pilot systems:

1. With Ekahau Site Survey software equipped with an Orinoco Gold 802.11b/g radio card and a GPS, the test team drove an automobile through each of the coverage areas and recorded all Wi-Fi signals. The antenna for the Wi-Fi radio was configured for recording signals outside of the automobile to discount attenuation of the automobile and make the measurements accurate for outdoor signal coverage assessment. An external antenna mounted on top of the automobile was used with the GPS in order to improve the accuracy of position information, which resulted in 10 feet average accuracy. The places driven for each of the pilot test areas included all streets and a representative sample of parking lots and driveways.
2. The test team conducted a series of connection tests at multiple locations using several brand radio cards to determine the minimum signal levels necessary to support connections and application usage. This provided a method for interpreting the signals found with the Ekahau software. It was found that 15dB SNR (signal-to-noise ratio) was necessary to maintain stable connections on the IBM and WFI pilot systems
3. With a handheld version of AirMagnet Analyzer equipped with an AirMagnet 802.11b/g radio card, the test team conducted signal testing inside facilities at sample areas, such as restaurants, stores, and office buildings, throughout each of the pilot test areas. The test team found that the average signal loss is 10dB from the street to just inside the facility. Because AirMagnet Analyzer uses a different radio card than Ekahau Site Survey, tests were done to compare the measurements taken with each test unit. This testing indicated that there was no significant difference. The variation between signal measurements taken with each unit was less than 1dB.
4. After collecting the signal information in outdoor and indoor areas, the test team observed the data and determined the extent of coverage based on a minimum of 15dB SNR.

The IBM and WFI pilot systems both met signal coverage requirements as stated in the RFP.

In order to support voice applications, such as Wi-Fi phones, the SNR should be at least 25dB in all areas. If this were a requirement, then the IBM and WFI pilot systems would not meet signal coverage requirements within most indoor facilities. Outdoor signal coverage based on 25dB or higher SNR would also cause the IBM and WFI pilot systems to fall below the 95 percent outdoor coverage requirements stated in the RFP.

As compared to the IBM system, the WFI system had the advantage of a much higher vantage point (rooftop approximately 15 stories high) for mounting the antennas at the

headend. This allowed most if not all mesh nodes of the WFI system to be within line of sight of the headend antennas. The IBM system made use of a much lower rooftop (approximately 8 stories high) for mounting the headend antennas. Many of the mesh nodes within the IBM system were not within line of sight of the headend antennas. Obstructions such as trees and buildings were between mesh nodes, gateways, and the headend. Despite these issues, the signal coverage of the IBM pilot system met requirements and was just as good if not better than the WFI system.

5.3 Performance Testing

The performance testing assessed the following test criteria:

Support an average net data throughput per subscriber of one 1Mbps (upstream and downstream) throughout the covered areas – measured against any point in the system.

Sufficient capacity of the system to support 676 subscribers per square mile throughout the pilot test coverage areas. This is based on the requirement to support 4,800 subscribers as stated in the RFP over the entire 7.1 square mile city.

The performance testing included the following for the IBM and WFI systems:

1. The test team connected a computer configured as an FTP file server to a wired port at the headend of the system. This offered a central point to run performance tests against.
2. The test team associated a laptop equipped with an Orinoco Gold 802.11b.g card to a mesh node. The location of this testing was chosen within the IBM and the WFI pilot areas in a manner to make the radio environment as equal as possible between the two systems in terms of SNR and noise. For both systems, the communications path was from the wireless laptop to the associated mesh node to an Alvarion gateway and then on to the headend and FTP file server.
3. The test team transferred a 16,000,000 byte file (128,000,000 bits) from the laptop to the FTP server (upstream) while measuring the time to complete the file transfer, throughput, channel utilization, and error rates. The same tests were run while transferring the file from the FTP server to the laptop (downstream). AirMagnet Analyzer was used to take measurements. These tests were run multiple times at each test location.

The IBM and WFI pilot systems exceed the minimum 1 Mbps upstream and downstream throughput requirements stated in the RFP.

Table 3 includes average upstream performance measurements for the IBM and WFI pilot systems.

Table 3. Average Upstream Performance Measurements

Measurement	IBM System	WFI System
File Upload Time	45 seconds	39 seconds
Upstream Transfer Rate	2.8 Mbps	3.3 Mbps
Node Association Data Rate	24-36 Mbps	24-36 Mbps

Table 4 includes average downstream performance measurements for the IBM and WFI pilot systems.

Table 4. Average Downstream Performance Measurements

Measurement	IBM System	WFI System
File Download Time	52 seconds	45 seconds
Transfer rate	2.5 Mbps	2.8 Mbps
Association Data Rate	24-36 Mbps	24-36 Mbps

The IBM and WFI pilot systems both have sufficient capacity to support 676 subscribers per square mile. This equates to approximately 20 subscribers per mesh node. The systems can both support this number of subscribers actively checking email and browsing the Internet simultaneously. There would not be enough capacity, however, for all 20 subscribers to simultaneously download large files at the throughput requirement of 1 Mbps.

5.4 Roaming Testing

The roaming testing assessed the following test criterion:

Seamless, in-motion usage (up to 60mph) throughout the coverage areas with no interruption to applications running on the user device.

The roaming testing included the following for the IBM and WFI systems:

1. With the FTP server connected to the system as described above in Section 5.3, the test team drove through the coverage area in an automobile at highest possible speed with a wireless laptop (equipped with an Orinoco Gold 802.11b/g radio) connected to the system and downloading a large file from the FTP server. The test team drove throughout the entire test area to determine how well the wireless laptop roams from one mesh node to another.

2. While performing the step above, the test team recorded wireless packet traces using AirMagnet Analyzer. The test team also made notes regarding indications given by the laptop regarding the connection status.
3. The test team observed the packet trace to determine roaming delays and whether the roaming took place successfully.

Due to traffic and speed limits, the maximum speed attained was 35 miles per hour when testing both pilot systems. Roaming was not seamless for both the IBM and the WFI systems. Both systems exhibited periodic disconnections from the network and average re-association times of up to a minute. Because the testing was done with a laptop and common radio card, these results are characteristic of typical user devices. This will mostly impact the downloading of larger files and the ability to support real-time voice applications while moving at vehicular speeds. Roaming would likely be better, however, if using a client device having a radio specially designed for roaming.

There were no issues with seamless roaming on either system when traveling at pedestrian speeds through the pilot test areas.

5.5 Battery Backup Testing

The battery backup testing assessed the following test criterion:

Battery and/or solar power backup for all network equipment sufficient to assure continuous operation at full power and functionality for a period of not less than one (1) hour in the absence of utility power.

The battery backup testing included the following for the IBM and WFI systems:

1. At a schedule time, the electrical power was removed from the pilot test equipment for a 1.5 hour period.
2. The test team ensured that a wireless laptop was able to connect successfully with a mesh node for a 1 hour period after the node's power was removed.

The IBM and WFI pilot systems demonstrated the ability to remain in operation for at least 1 hour after the electrical power was removed.